

Volume 4. Aircraft Equipment and Operational Authorizations

CHAPTER 8. GROUND DEICING/ANTI-ICING PROGRAMS

SECTION 3. OTHER MEANS OF DEICING/ANTI-ICING.

1757. GROUND DEICING USING INFRARED (IR) ENERGY.

A. Background. Given the cost of deicing with conventional fluids and the recent demand for alternative deicing methods, interest in IR deicing systems has increased. IR energy has been used by the industrial and domestic heating industry for several decades. Studies have shown that, when used properly, IR energy has no harmful effects on humans or animals. Federal Aviation Administration (FAA) tests, conducted under a Cooperative Research and Development Agreement (CRDA), have also demonstrated that IR energy does not pass through the aircraft surfaces and has a negligible effect on cabin internal temperature. The FAA encourages the development and use of alternative methods of deicing such as IR systems. However, as with all deicing equipment, it is necessary to ensure that IR deicing systems are used with the highest degree of competence and safety. Consequently, the FAA has developed the general safety criteria in AC 120-89, Ground Deicing Using Infrared Energy, as amended, for certificate holders to use to evaluate IR deicing systems for use in a certificate holder's approved deice/anti-icing program.

B. Related Documents.

(1) FAA Publications.

(a) AC 120-89, Ground Deicing Using Infrared Energy, as amended.

(b) AC 120-60, Ground Deicing and Anti-icing Programs, as amended.

(c) The annual Flight Standards Information Bulletin (FSAT) on ground deicing.

(d) AC 150/5300-14, Design of Aircraft Deicing Facilities, Change 2.

(2) Publications of the Society of Automotive Engineers (SAE). Copies of the following documents may be obtained by writing to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA, 15096-0001.

(a) Aerospace Materials Specification (AMS) 1424, Deicing/Anti-Icing, Fluid, Aircraft, SAE Type I.

(b) Aerospace Materials Specification (AMS) 1428, Deicing/Anti-Icing, Fluid, Aircraft, Non-Newtonian, Pseudo-Plastic, SAE Type II, III & IV.

(c) Aerospace Recommended Practice (ARP) 4737, Aircraft Deicing/Anti-Icing Methods.

(d) Aerospace Recommended Practices (ARP) 5149, Training Program Guidelines for Deicing/Anti-icing of Aircraft on Ground.

(3) Publications of the International Standards Organization (ISO). Copies of the following documents may be obtained from the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY, 10036, (212) 642-4900.

(a) ISO 11075, Aerospace-Aircraft Deicing/Anti-Icing Newtonian Fluids ISO Type I.

(b) ISO 11076, Aerospace-Aircraft Deicing/Anti-Icing Methods with Fluids.

(c) ISO 11078, Aerospace-Aircraft Deicing/Anti-Icing Non-Newtonian Fluids ISO Type II.

(4) Safety Studies.

(a) American Gas Association (AGA) Research Bulletin #92, November, 1962.

(b) Ocular Effects of Radiation, D. Cogan, AMA Archives of Industrial Health Vol. 20, #4, pp. 293-296, 1959.

(c) Basic Principles of Ventilation and Heating, T. Bedford, et. al., H. K. Lewis Company, Ltd., 1948.

C. Use Of IR Systems.

(1) *IR Emitter Units.* IR energy can be produced in a number of ways. The method most commonly used for deicing is a gas-fired IR system. This system uses gas-fired units suspended from the ceiling of the modular shelter facility. These units are controlled by an on-site operator located at a control station within the facility. The system can be instantly turned off using emergency shutdown buttons located either at the control station or around the facility.

(2) How an IR system Deices Aircraft.

(a) *Critical Aircraft Surfaces.* Unlike heated hangars where convection heat energy is generally distributed, IR energy does not heat the air that it passes through. The energy is concentrated on specific areas. When deicing, the IR emitter units impart sufficient IR focused energy on the aircraft surfaces in line-of-sight of the IR units to melt the frozen contaminants on those surfaces.

(b) *Aircraft Underbody.* If the energy does not reach the underbody of the aircraft, including the landing gear, ice could be retained at these locations even though the upper parts of the aircraft are free of ice contamination. In situations where the underbody is clean it could be possible, under certain conditions, for water to refreeze on parts of the underbody as it runs off of the wing and other upper portions of the aircraft. However, heat always seeks a balance with surrounding areas and always moves from the warmer medium to the cooler medium. In-service experience has demonstrated that some of the heat energy reflected by the facility structure, in addition to the heat energy which is absorbed by the ground before the aircraft arrives, will re-radiate to the colder under-wing and landing gear surfaces to remove frozen contamination. As with all deicing methods, the air carrier is responsible for performing a post-deicing inspection of these areas to ensure that all frozen contamination has been removed.

(3) *Size of IR Deicing Facilities.* These systems have been used to deice commuter and moderate-sized (e.g., B-757) aircraft. Systems capable of deicing large aircraft (e.g., B-747) may also be available.

(4) *Use of Deicing Fluid with IR Systems.* Deicing fluid can be used in conjunction with IR energy in cases where water refreezes on part of the airplane not exposed to IR energy.

(5) *Responsibilities of Flightcrews.* As with all deicing methods, when an aircraft is deiced using an IR facility, it remains the responsibility of flightcrews to assure that all contamination has been removed from the aircraft and that no further contamination is likely to occur before take off.

(6) *Deicing and Anti-icing.* An IR system is used to deice an aircraft. An IR system does not function as an anti-icing agent. No Holdover Times (HOT) exist for IR energy. Anti-icing fluids may be used in conjunction with an IR system, after an aircraft has been deiced, if the aircraft is expected to operate in active ground icing conditions. If contamination is likely to occur after IR deicing and the facility includes the application of an anti-icing freezing point depressant (FPD), the IR facility operator's use of the FPD must comply with the requirements of section 121.629(c).

D. Approval Criteria. The FAA does not certificate IR deicing facilities. Therefore, a certificate holder who wishes

to use an IR facility should confirm that the IR facility meets the criteria of AC 120-89, Ground Deicing Using Infrared Energy, or provide an alternative means acceptable to the FAA of assuring the operational safety of the deicing facility, with supporting documentation, before including that IR facility in its program/plan. Using IR energy to deice airplanes can be part of any certificate holder's deicing/anti-icing program/plan regardless of whether the certificate holder is operating under part 121, 125, or 135.

(1) Along with the guidance in volume 4, chapter 8, section 2, Principal Operations Inspectors (POI) should consider the follow criteria before approving the use of an IR facility as part of a certificate holder's ground deicing program. The certificate holder must show the POI that the IR facility addresses these criteria.

(a) The IR facility operator should provide an appropriate description of the system (hardware, energy source, markings, etc.).

(b) The IR deicing system should perform its intended purpose, i.e., it must be capable of effectively deicing an aircraft.

(c) The IR deicing systems should not create a hazard to:

- i. Aircraft.
 - ii. Ground personnel.
 - iii. Crew members.
 - iv. Passengers.
 - v. Cargo.
 - vi. Airport facilities.
- IR energy has no effect on navigational aids, antennas, communication facilities, and building as it is in a different area of the electromagnetic spectrum. However, the systems location (as with any airport structure) should be approved with regards to tower sight-lines and runway obstacle free areas, etc. This is normally accomplished by the local airport authority in their applications to the FAA.
 - The FAA requires that IR aircraft ground deicing facilities be designed to operate with the IR energy source positioned at least ten feet away from the aircraft surface.

(d) Any IR system for approval should be in general agreement with appropriate industry standards, as created by groups such as the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO), and should conform to applicable FAA documents.

(e) Any process for approving the operational use of an IR system should follow established guidelines set by industry groups, such as SAE, ISO, Air Transport Association (ATA), International Civil Aviation Organization (ICAO), and the General Aviation Manufacturing Association (GAMA). These guidelines should address:

i. The training of flightcrew, IR equipment ground operator personnel, facility maintenance personnel, and anti-icing ground personnel.

ii. Melted ice flowing into aerodynamically quiet areas and refreezing (SAE ARP4737).

iii. Additional deicing and anti-icing requirements.

iv. Environmental considerations.

(f) Notification must be obtained from the aircraft manufacturer that the IR energy can safely be used on composite aircraft surfaces.

(2) Once a certificate holder has determined that the IR deicing system to be used by a deicing facility meets these criteria, the certificate holder should present its findings to the POI for review. Once the POI determines from the findings presented that the IR deicing system meets all criteria, the system may become part of the certificate holder's deicing/anti-icing program.

1758. - 1774. RESERVED.

[PAGES 4-1115 THROUGH 4-1140 RESERVED]

[THIS PAGE INTENTIONALLY LEFT BLANK]